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(54) [Title of invention]

Structure between wirings of integrated circuits

(57) [Abstract]

[Purpose]

This invention aims to have a structure between wirings of integrated circuits that sufficiently prevent interference between wirings even if the distance of wirings are short.

[Construction]

It has a conductive layer 11 in wiring which is irrelative with operation of circuit element in the insulating film 4 and 5 between wirings 1 on the same surface of the integrated circuit. Since the conductive layer 11 acts as a buffer between wirings 1, it does not transfer the noise to the next wirings if specific noise occurs and it prevents interference between wirings.

1. Lower layer wiring (wiring)
2. Upper layer wiring
3. Interlayer insulation film (insulation film)
4. Interlayer insulation film (insulation film)
5. Conductive layer

[Scope of claims]

[Claim 1] The structure between wirings of integrated circuit that features having conductive layers which is irrelative with the operation of the circuit element in the insulating film between wirings on the same surface of the integrated circuit.

[Claim 2] On the insulating film between lower layer wiring and upper layer wiring of the integrated circuit, above mentioned lower layer wire and upper layer wire are placed separately. It is the structure of the integrated circuit that features having a flat conductive layer which is irrelative with operation of circuit element.

[Detailed information of the invention]

[0001]

[Field of industrial application]

This invention is for wiring structure of integrated circuits.

[0002]

[Conventional technology]

The integrated circuit technology consists of electric circuits which interlock with conductive wire (wiring) such as aluminum and circuit element such as transistor, resistance or capacity. These wirings are electrically separated by the insulating film. However, when the integration degree increases the distance between wirings will get closer, and will be accumulated with 2nd layer and 3rd layer through the interlayer film.

[0003]

Figure 3 shows a cross-section view of the wiring structure of above-mentioned conventional integrated circuit. In this diagram, 1 is a lower layer wiring placed in several places on the same surface and 2 is an upper layer wiring accumulated on the lower layer wiring 1 and placed in several places in a direction perpendicular to this lower layer wiring 1. 3 is a base interlayer insulating film to cover the bottom surface of the lower layer wiring 1. 4 is an interlayer insulating film to cover side and top surface of the lower layer wiring 1. 5 is placed between the interlayer insulating film 4 and the upper layer wiring 2, and is a base interlayer insulating film to cover the bottom surface of the upper layer wiring 2. 6 is an interlayer insulating film to cover side and top of the upper layer wiring 2.

[0004]

Therefore, lower and upper layer wiring 1 and 2 are completely and electrically separated from each other by interlayer insulating film 3, 4, 5, and 6, and sends an electrical signal individually to each interlocked circuit element. If this electrical signal is digital element, it is high/low pattern signal which is switched between normal 0V low status and nV high status in interval of nanosecond and micro second. Therefore, the lower and upper layer wiring 1 and 2 are required to send an electric signal to target circuit element in accurate and rapid manner.

[0005]

[Problems to be resolved by the invention]

However, in the increased integrated degree circuit such as lower layer wiring 1 and upper layer wiring 2 that mentioned above, the distance between wirings are short in the same surface and upper/lower layer. Therefore, interference between wirings will easily occur in the same layers and between the lower layer wiring 1 and upper layer wiring 2.

[0006]

In other words, if noise occurs somehow in one wiring, this noise may be transferred to wiring nearby (up/down or right/left), and causes disadvantage of not sending the electric signal to several circuit element in accurate and fast manner.

[0007] This invention is designed to solve above-mentioned problem, and it aims to provide the structure between wirings of integrated wiring that sufficiently prevent interference between wirings even if the distance of wirings are short.

[0008]

[Means of solving the problems]

Primary invention of this invention is to have conductive layer that is irrelative with operation of circuit element in the insulating film between wirings on the same layer of the integrated circuit.

[0009]

Secondary invention of this invention is to have a conductive layer that is irrelative with operation of circuit element placed to separate the lower layer wiring and upper layer wiring in the insulating film between lower and upper layer wiring of the integrated circuit.

[0010]

[Operation of the invention]

As a primary invention of this invention, it have a conductive layer that is irrelative with operation of circuit in the insulating film between wirings on the same layer of the integrated circuit, this conductive layer film act as a buffer between lower and upper layer wirings and prevent transferring the noise to other nearby wiring when noise occurs in one of these wirings. In other words, it prevents wire interfering between wirings.

[0011]

As a secondary invention of this invention, it have a conductive layer that is irrelative with operation of circuit element placed to separate the lower layer wiring and upper layer wiring in the insulating film between lower and upper layer wiring of the integrated circuit, this conductive layer film act as a buffer between lower and upper layer wirings and prevent transferring the noise to other nearby wiring when noise occurs in one of these wirings. In other words, it prevents wire interfering between lower and upper layer wirings.

[0012]

[Working example]

Working example of this invention is described below by using diagram.

Example 1: Figure 1 shows one working example of structure between wirings of integrated circuit related to primary invention of this invention. In this diagram, 11 is multi conductive layer (no electric signal applied) that is irrelative with operation of circuit element and is designed to mount in concave portion between interlayer film 4 and lower layer wiring 1. It is formed by CVD (Chemical Vapor Deposition) with polysilicon doped with impurity such as W (tungsten), P (phosphorus), and B (boron). In addition, interlayer insulating film 5 is formed on top of this conductive layer 11.

[0014]

Next, it explains operation of this conductive layer 11.

This conductive layer 11 is a conductive material placed parallel to the lower layer wiring 1 on the same surface and blocks between these lower layers wiring 1. It acts as buffer (impingement protection) between lower layers wiring 1 and prevents wire interference between lower layers wiring 1. Therefore, if noise occurs somehow in any one of the lower layer wiring 1, the noise will be absorbed by the conductive layer 11 next to this lower layer wiring 1 and the conductive layer will prevent transferring this noise to the other lower layer wiring 1. In addition, this conductive layer 11 can be placed between upper layer wiring 2.

[0015] Maintaining an electric-potential of this conductive layer 11 in the middle of electric signal of high/low pattern that applied to the lower layer wiring 1 prevents delay or deterioration of electric signal caused by capacity coupling of capacity between wirings when both low and high signal exists instantly between nearby lower layer wiring 1.

[0016] In other words, the interlayer insulating film 4 is derivative and composes a capacity (capacity between wirings) between nearby lower layer wiring 1. Then, an electric signal moves in the lower layer wiring 1 while charging this capacity. Therefore, if capacity occurs in the lower layer wiring 1 with low and high signal nearby, the capacity between wirings increases and causes a delay or deterioration of electric

signal, and then leads to slow down of access time (operation speed) or malfunction. In this case, the conductive layer 11 maintains middle electric-potential of low/high signals, and it can control the capacity between wirings small. In result, delay of electric signal or deterioration of electric-potential will not occur and the electric signal will be transfer to circuit element accurately and rapidly.

[0017] In addition, since the conductive layer 11 is formed in concave portion between the lower layer wiring 1 in the interlayer insulating film 4, structural level difference is reduced and makes next processing process easy and improves reliability of the element.

[0018] Example 2: Figure 2 shows one working example of structure between wirings of integrated circuit related to secondary invention of this invention. 12 is a flat thin conductive film formed on the interlayer insulating film 4 and is irrelative with operation of circuit element. It uses same material and forming method as in example 1, conductive layer 11. Also, other structure, wiring of integrated circuit, is same as in example 1.

[0019] This conductive film 12 is placed to separate the lower layer wiring 1 and upper layer wiring 2. It acts as buffer between these layers. In addition, a part of this conductive film 12 between lower layer wiring 1 placed crookedly in concave portion of the interlayer film 4 between lower layer wiring 1. It acts as buffer between lower layer wiring 1.

[0020] Therefore, when a noise occur any one of lower layer wiring 1, this conductive film 12 prevents noise transfer to the other lower layer wiring 1 nearby and also prevents noise transfer to the upper layer wiring 2 nearby. In addition, if noise occurs any one of upper layer wiring 2, this conductive film 12 prevents noise transfer to lower layer wiring 1.

[0021] This conductive film 21 can maintain in middle of electric-potential of high/low signal to prevent delay of electric signal or deterioration of electric-potential caused by capacity coupling of capacity between wirings when both low and high signal exists instantly between wirings nearby.

[0022] In the above-mentioned example 2, the lower layer wiring 1 of this conductive film 12 is also placed crookedly in concave portion between the lower layer wiring 1. However, it can be placed crookedly in concave portion between upper layer wiring 2. In this case, if noise occurs any one of upper layer wiring 2, this conductive film 12 can prevent noise transfer to the other upper layer wiring 2 nearby as well as noise transfer to the lower layer wiring 1 which is close to this noise.

[0023]

[Effect of the invention] This invention is constructed as mentioned above, and brings effect described below.

[0024] According to primary invention of this invention, it has a conductive layer which is irrelative with operation of circuit element in the insulating film between wirings on the same layer of the integrated circuit. By acting this conductive layer as buffer, it can control wire interference between wirings sufficiently even if the distance of wirings are short.

[0025] According to secondary invention of this invention, it has a conductive layer which is irrelative with operation of circuit element placed to separate the lower layer wiring and upper layer wiring in the insulating

film between lower and upper layer wiring of the integrated circuit. By acting this conductive layer as buffer, it can control wire interference between lower and upper layer wirings sufficiently even if the distance of wirings are short.

[Brief description of the drawings]

[Figure 1] It is a frame format cross-section diagram of wiring structure of integrated circuit related to example 1 of this invention.

[Figure 2] It is a frame format cross-section diagram of wiring structure of integrated circuit related to example 2 of this invention.

[Figure 3] It is a frame format cross-section diagram of wiring structure of conventional integrated circuit.

[Legend]

1. Lower layer wiring (wiring)
2. Upper layer wiring (wiring)
4. Interlayer insulating film (insulating film)
5. Interlayer insulating film (insulating film)
11. Conductive layer
12. Conductive layer film

[Figure 1]

1. Lower layer wiring (wiring)
2. Upper layer wiring
4. Interlayer insulating film (insulating film)
5. Interlayer insulating film (insulating film)
11. Conductive layer

[Figure 2]

12. Conductive layer film

[Figure 3]